Milesight

CT10x

Smart Current Transformer

User Guide

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Chapter 1. Preface

Copyright Statement

Safety Instruction

These instructions are intended to ensure that user can use the product correctly to avoid danger or property loss. Milesight will not shoulder responsibility for any loss or damage resulting from not following the instructions of this operating guide.

CAUTION:
Injury or equipment damage may be caused if any of these cautions are neglected.

- The device is not intended to be used as a reference sensor, and Milesight will not should responsibility for any damage which may result from inaccurate readings.
- The installation and maintenance must be conducted by a qualified service person and should strictly comply with the electrical safety regulations of the local region.
- Do not overload the maximum capacity to avoid damage to the device.
- The device must not be disassembled or remodeled in any way.
- Do not place the device close to objects with naked flames, heat source (oven or sunlight), cold source, liquid and extreme temperature changes.
- The device is intended only for indoor use. Do not place the device where the temperature is below/above the operating range.
- Keep the device away from water to prevent electric shock.
- Use the device opening clean and free of dust before installation. Dusty or dirty environments may prevent the proper operation of this device.
- Do not drop the device or subject it to physical shocks and strong vibration.

Revision History

Release Date	Version	Revision Content
Jan 12, 2024	V1.0	Initial version
Jun 6, 2024	V1.1	1. Support flexible detachable design; 2. Support cable temperature sensor.
Feb 26, 2025	V1.2	Add CT105.

Chapter 2. Product Introduction

Overview

CT10x is a LoRaWAN® Smart Current Transformer for monitoring the energy and analyzing consumption remotely. CT10x provides multiple current options to suit energy monitoring and support sending threshold alarms. CT10x is detachable, the compact size and clamp design allow it to be installed in any indoor space quickly and safely without de-energizing a facility, simplifying the installation and saving the cost. Compliant with Milesight LoRaWAN® gateway and Milesight Development Platform solution, CT10x can be monitored via webpage remotely.

CT10x is widely used for energy motoring of smart buildings, machine failure detection and prevention, etc.

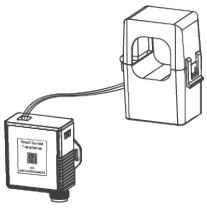
Features

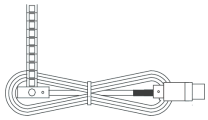
- Report the RMS current and accumulated current data by minutes
- High measuring accuracy with a sampling frequency of up to 3.3 kHz
- Self-powered, free from batteries or external wires
- Utilize a sampling rate of up to 1s for real-time monitoring and quick alarm response
- Compact size allows for installation in narrow scenarios
- Support flexible detachable design to accommodate various installation environments
- Non-invasive clamp design ensures easy and safe installation without the need for power de-energizing
- Equipped with LED indicator to indicate working status and alarms
- Support to connect to a temperature sensor via USB for cable temperature measurement
- Compliant with standard LoRaWAN® gateways and network servers
- Compliant with Milesight Development Platform
- Support Firmware Update Over the Air (FUOTA)

Chapter 3. Hardware Introduction

Packing List

or





1 × CT10x Current Transformer

1 × USB-C NTC Sensor (1m)

1 x LoRaWAN® Stubby Antenna

1 x LoRaWAN® Magnetic Antenna (Optional)

1 × Warranty Card

1 × Quick Guide

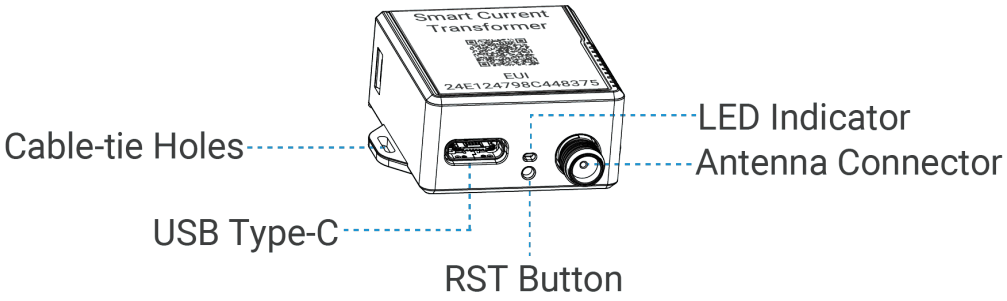
CT101/CT103 Only

1 × Transceiver Cover

1 × Extension Cable (1m)

Note:
If any of the above items are missing or damaged, please contact your sales representative.

Hardware Overview



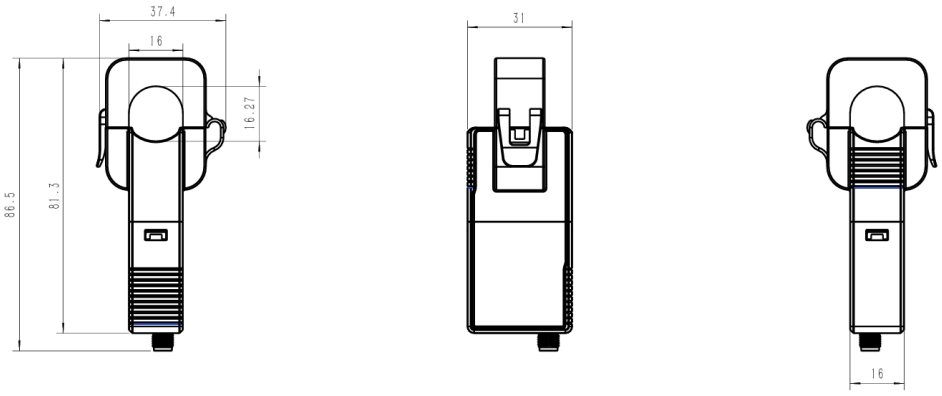
Button and LED Indicator

Function	Action	LED Indicator
Normal Work	The device is functioning properly.	Green light blinking every 2s
Low Power Mode	The device measures and reports at reduced rate.	Green light blinking every 5s
Low Voltage Mode	The device only measures at reduced rate.	Green light blinking every 10s
Alarm	The current is over the threshold or measuring range, or the temperature is over the threshold.	Red light fast blinking
Reboot	Quick press the RST button once.	Green light blinking Once

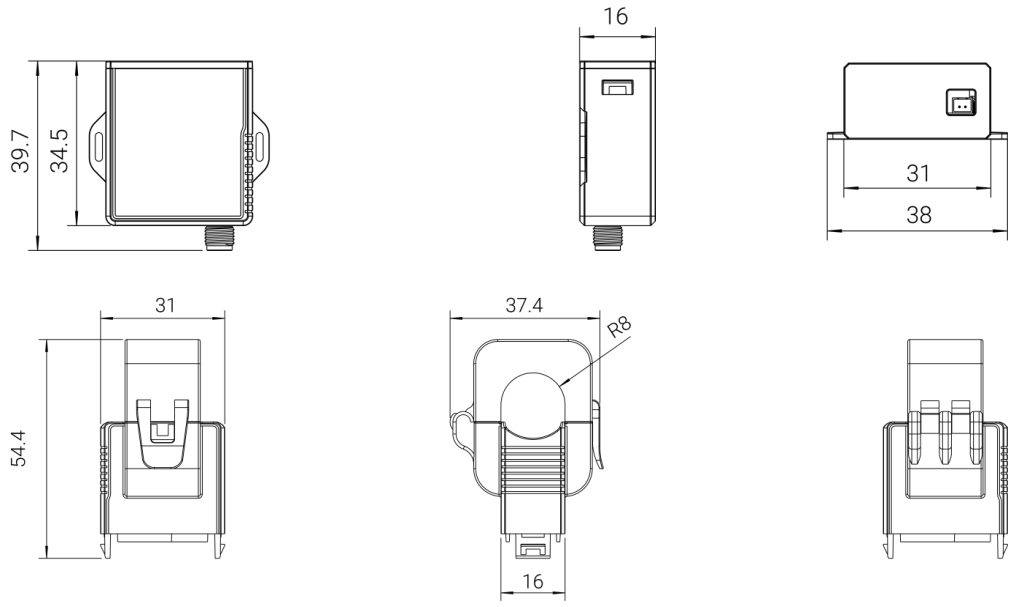
Note:
if not blinking even the device is installed, it is possible that the start circuit of the cable is too small and will take some minutes to charge the device.

Dimensions (mm)

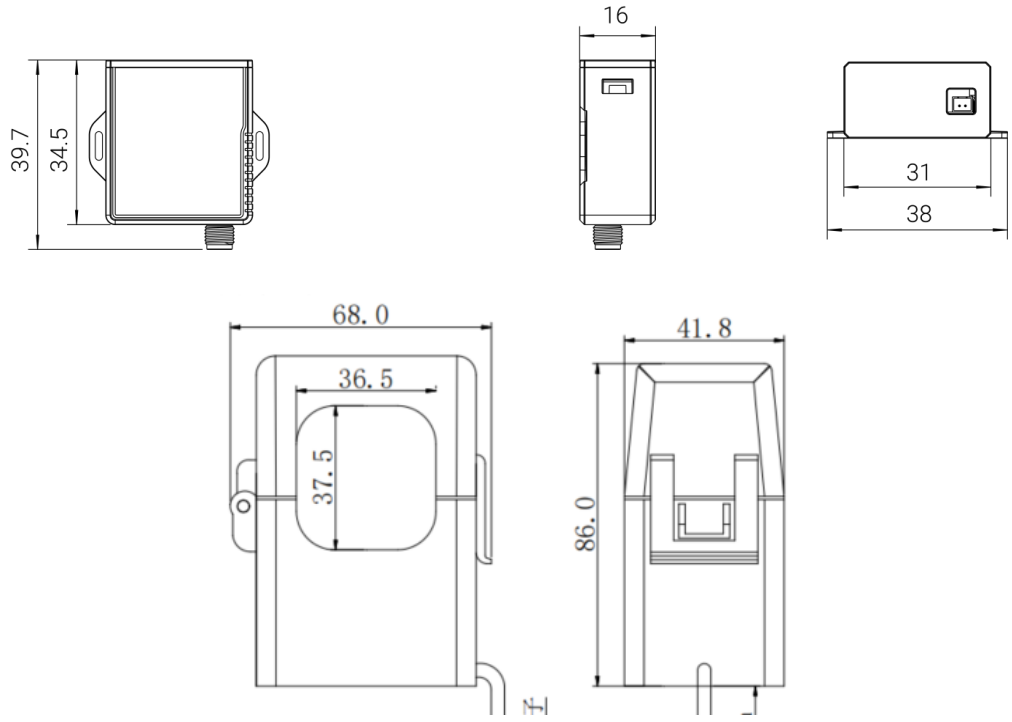
CT101/CT103:



CT101/CT103 (Detachable Design):


16
39.7
34.5
31
38
31
54.4
37.4
R8
16

CT105:

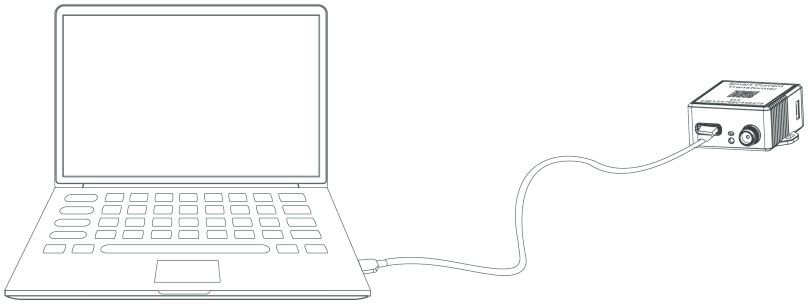

16
39.7
34.5
31
38
68.0
36.5
37.5
41.8
86.0

Chapter 4. Operation Guide

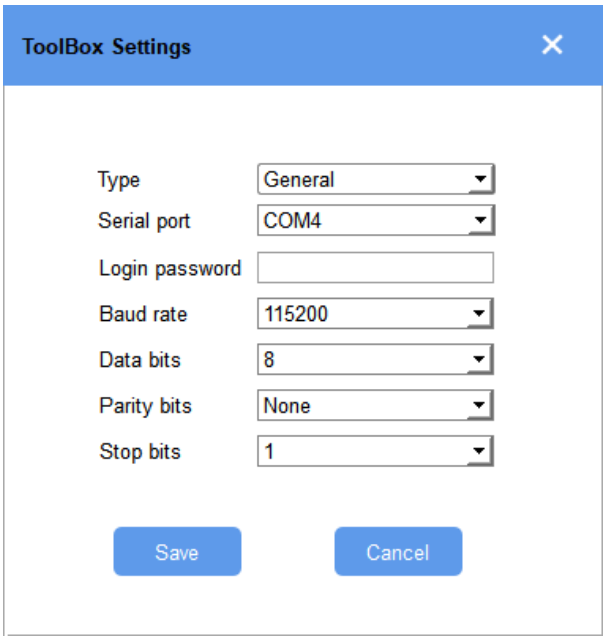
Access the Sensor

The device can be powered and configured via a Type-C port for configuration and console.

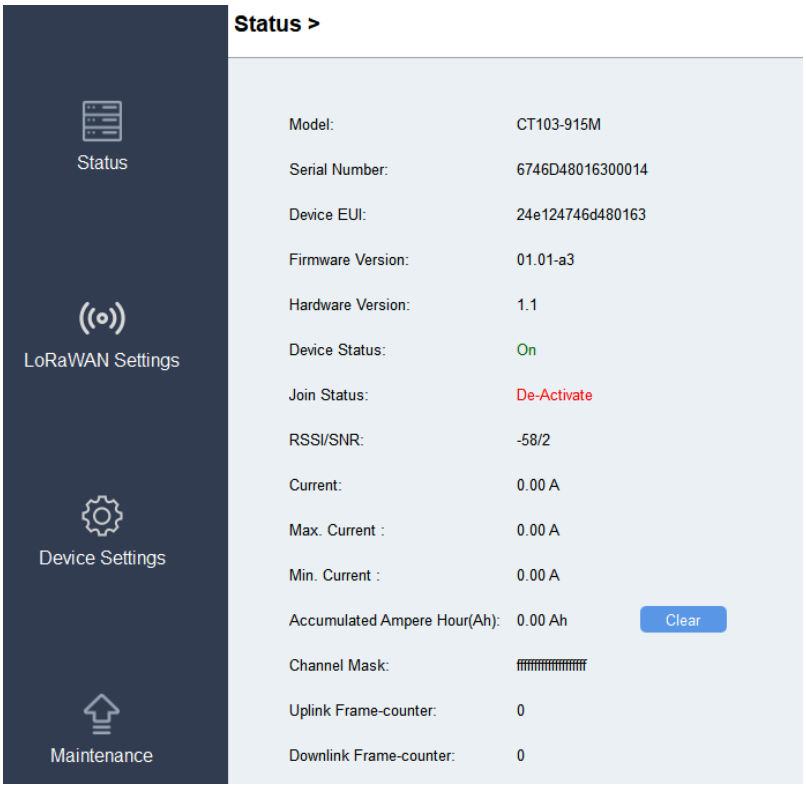
1. Download ToolBox software from Milesight website.
2. Connect the device to a computer via the Type-C port.



3. Open the ToolBox and select type as **General**, then click password to log into the ToolBox. (Default password: **123456**. In order to protect the security of the device, please change device password when first configuration.)



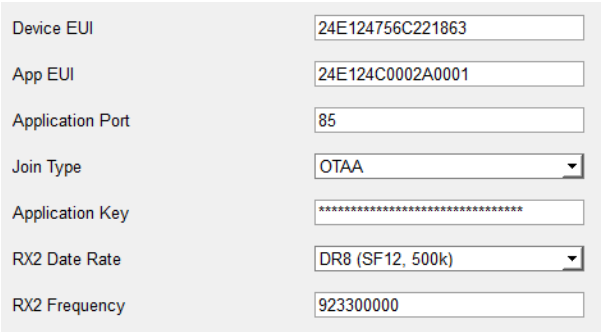
4. After logging into the ToolBox, you can check device status and change device settings.

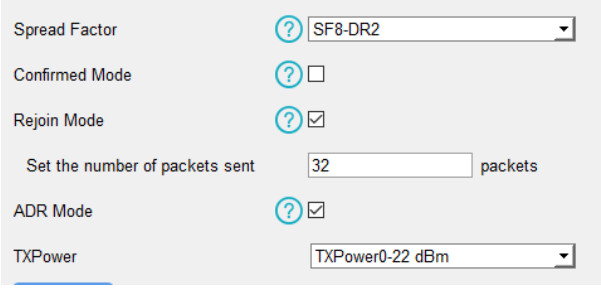


LoRaWAN® Settings

Basic Setting

Configure AppEUI, Join Type, Application Key, and other information. You can also keep all the default settings.



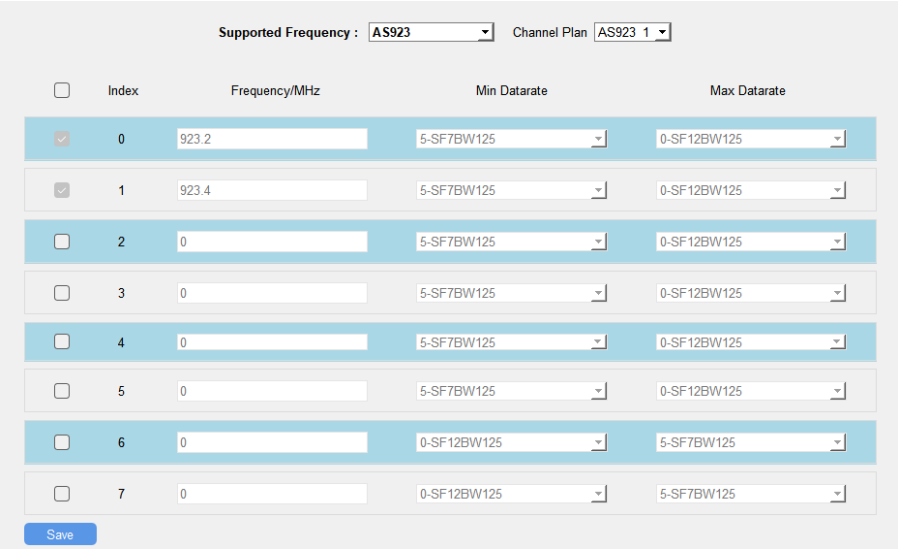


Parameters	Description
Device EUI	Unique ID of the device which can be found on the device. **Note:** please contact sales for device EUI list if you have many units.
App EUI	The default App EUI (join EUI) is 24E124C0002A0001.
Application Port	The port used for sending and receiving data, the default port is 85.
Join Type	OTAA and ABP mode are available. **Note:** it's necessary to select OTAA mode if connecting device to Milesight IoT Cloud or Milesight Development Platform.
Application Key	Appkey for OTAA mode, default value: "Device EUI" + "Device EUI" (since Q4 of 2025). Example: 24e124123456789024e1241234567890 **Note:** • The default value of earlier devices is 5572404C696E6B4C6F52613230313823. • Please contact sales before purchase if you require random App Keys.
Network Session Key	Nwkskey for ABP mode, the default is 5572404C696E6B4C6F52613230313823.

Parameters	Description
Application Session Key	Appskey for ABP mode, the default is 5572404C696E6B4C6F52613230313823.
Device Address	DevAddr for ABP mode, default is the 5th to 12th digits of SN.
Confirmed Mode	If the device does not receive ACK packet from network server, it will resend data once.
Rejoin Mode	Reporting interval≤35 mins: the device will send a specific number of LinkCheck-Req MAC packets to the network server every reporting interval or every double reporting interval to validate connectivity; If there is no response, the device will re-join the network. Reporting interval > 35 mins: the device will send a specific number of LinkCheck-Req MAC packets to the network server every reporting interval to validate connectivity; If there is no response, the device will re-join the network. **Note:** 1. Only OTAA mode supports rejoin mode. 2. The actual sending number is **Set the number of packets sent** +1.
ADR Mode	Enable or disable network server to adjust Spreading Factor, Bandwidth an Tx Power to optimize data rates, airtime and energy consumption in the network.
Spreading Factor	If ADR mode is disabled, the device will send uplink data following this SF parameter. The higher the spreading factor, the longer the transmission distance, the slower the transmission speed and the more the consumption.
Tx Power	Tx power (transmit power) refers to the strength of the outgoing signal transmitted by the device. This is defined by LoRa alliance.
RX2 Data Rate	RX2 data rate to receive downlinks.
RX2 Frequency	RX2 frequency to receive downlinks. Unit: Hz

LoRaWAN Frequency Settings

Go to **LoRaWAN Settings > Channel** to select supported frequency and select channels to send uplinks. Make sure the channels match what you set in the LoRaWAN® gateway.



If frequency is one of CN470/AU915/US915, enter the index of the channel to enable in the input box, making them separated by commas.

Examples:

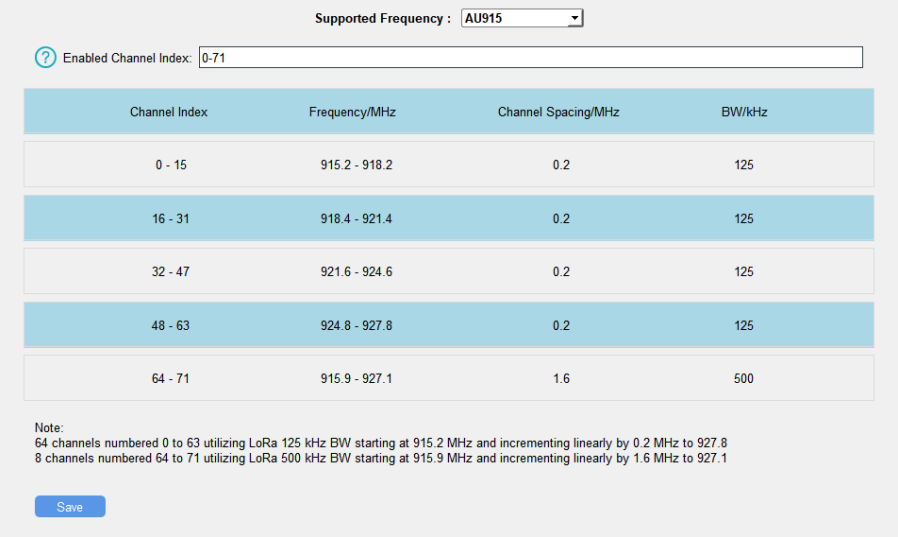
1, 40: Enabling Channel 1 and Channel 40

1-40: Enabling Channel 1 to Channel 40

1-40, 60: Enabling Channel 1 to Channel 40 and Channel 60

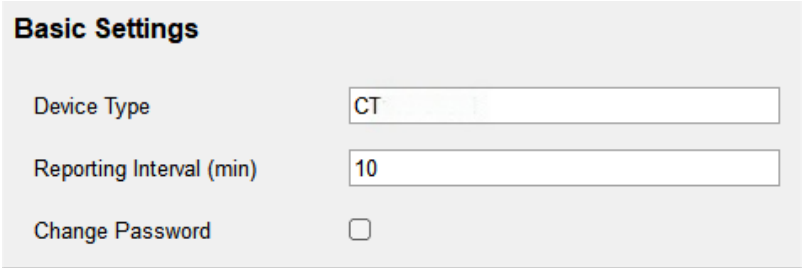
All: Enabling all channels

Null: Indicate that all channels are disabled



Basic & Alarm Settings

Basic Settings

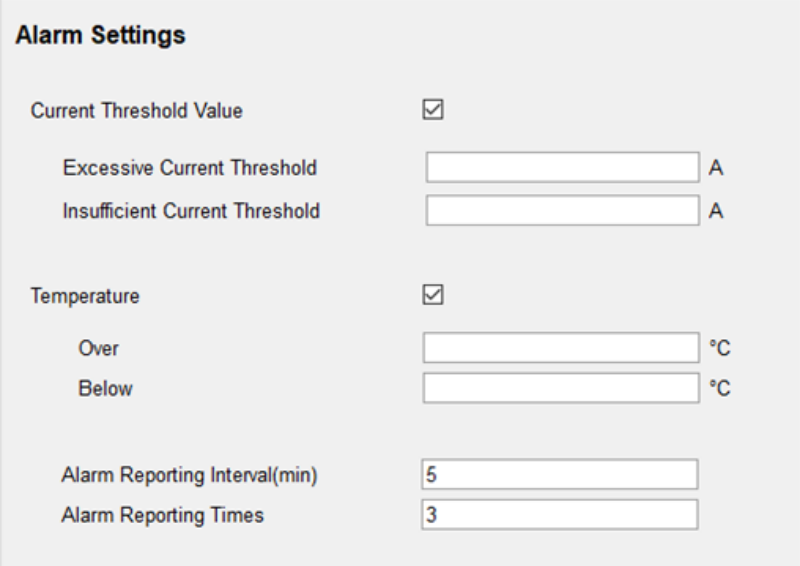


Parameters	Description
Reporting Interval	The interval of reporting current data. Default: 10 mins, Range: 1 - 1440 mins **Note:** 1. It is necessary to meet the minimum reporting current requirement to report properly.

Reporting Interval	CT101	CT103	CT105
1 min	6A	12A	30A
10 min	4A	6A	10A

Parameters	Description
	To measure lower currents, the device must be powered via USB. 2. If the device does not meet the minimum reporting current requirement, it will enter either low-voltage mode or low-power mode. In low-power mode, the reporting interval is fixed at 30 minutes. In low-voltage mode, the device will stop reporting. The operating mode can be identified by the LED indicator. 3. If the device meets the minimum reporting current requirement but still enters low-voltage or low-power mode, this indicates that the measured conductor is faulty or has no power. Please inspect and repair it promptly.
Change Password	Change the password of the device for ToolBox configuration.

Alarm Settings



Parameters	Description
Alarm Reporting Interval (min)	The interval to report alarm packet after alarm triggers. This interval should be less than reporting interval.
Alarm Reporting Times	Alarm packet report times after alarm triggers.
Current Threshold Value	

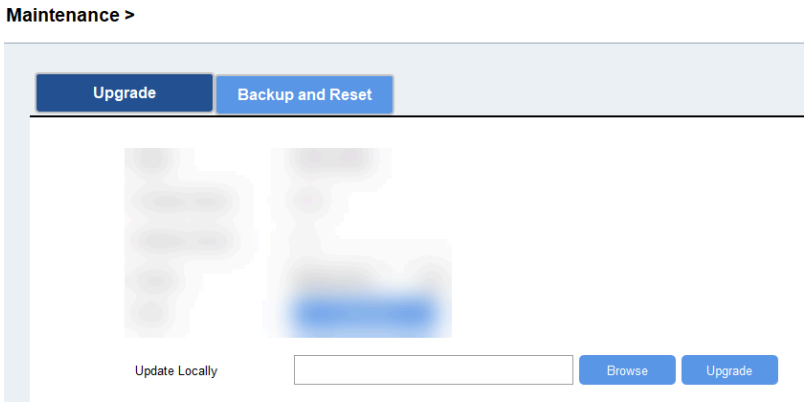
Parameters	Description
Excessive Current Threshold	The maximum current threshold value.
Insufficient Current Threshold	The minimum current threshold value.
Temperature	
Over	The maximum temperature threshold value.
Below	The maximum temperature threshold value.

Note:
Current overrange alarm is fixed as enabled, the alarm reporting interval is fixed as 5 minutes and the alarm reporting time is fixed as 3.

Maintenance

Upgrade via ToolBox Software

1. Download firmware from Milesight official website to your computer.
2. Connect the device to computer via USB port, then log in to the device via ToolBox software.
3. Go to **Maintenance > Upgrade** page, click **Browse** to upload the firmware file and click **Upgrade** to upgrade the device.



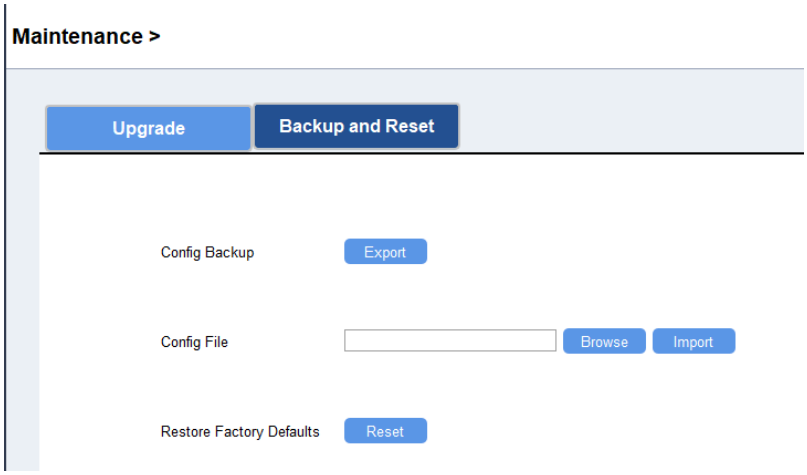
Backup and Restore via ToolBox Software

1. Connect the device to a computer via USB port, then log in to the device via ToolBox software.

2. Configure the device and save the settings.

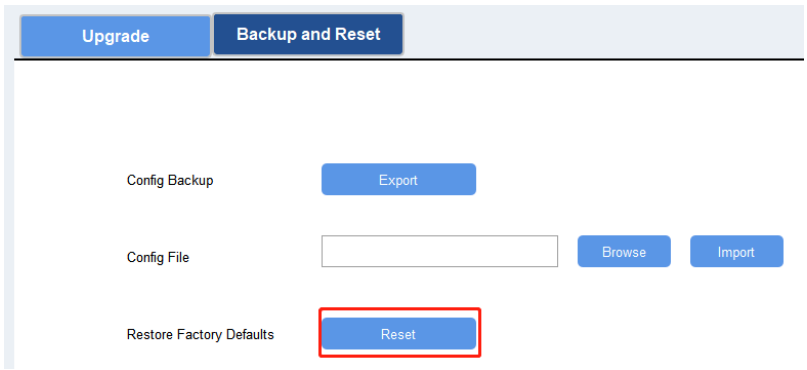
3. Go to **Maintenance > Upgrade** page, click **Export** to save the template file to the computer.

4. Connect another target device to the same computer, go to **Maintenance > Upgrade** page to import the template file.



Reset to Factory Default

Go to **Maintenance > Backup and Reset** page, click **Reset** to reset the device.



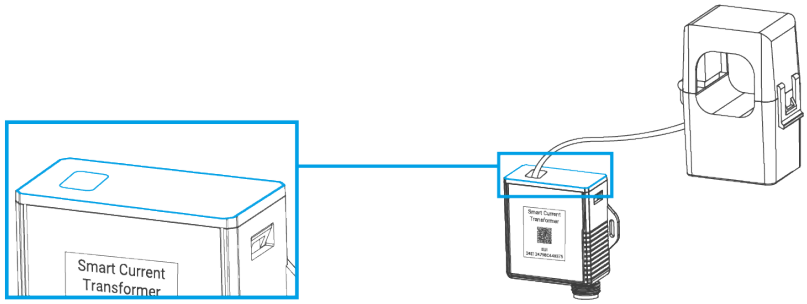
Reboot

Quick press the RST button once or send downlink command to reboot.

Chapter 5. Installation

Current Transformer Assembly (CT105 Only)

CT105 can be connected to the connectors of transceiver.

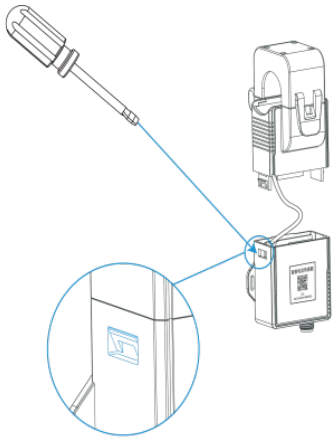


Extension Cable Assembly (CT101/CT103 Optional)

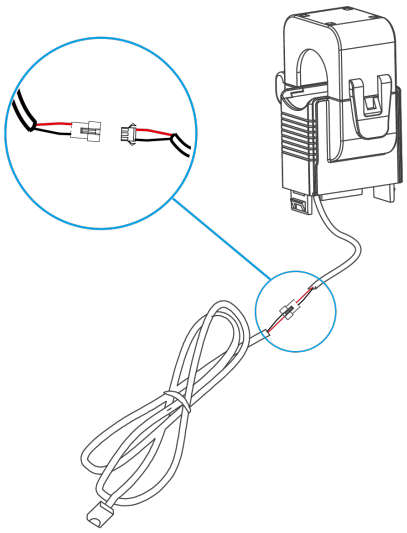
CT101/CT103 supports for using the current transformer probe separately from the transceiver or with an extension cable.

1. Press the clip on the side with a screwdriver and separate CT and transceiver.

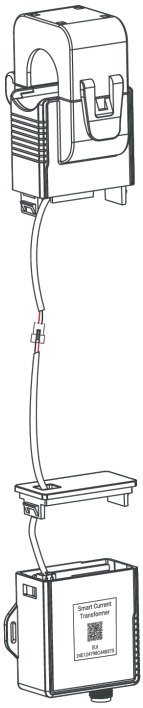
> **Attention:**
> Do not attempt to disassemble the device by force.



2. Disconnect the wiring socket of the probe from the transceiver, then connect the extension cable to the CT clip.

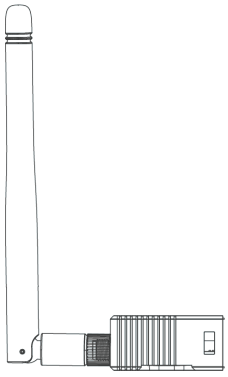


3. Pass the other end of the extension cable through the transceiver cover, then connect to the transceiver.



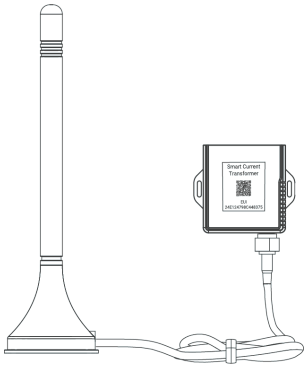
Antenna Installation

Rotate the antenna into the antenna connector. The antenna should be installed vertically and kept away from metal objects and obstacles.



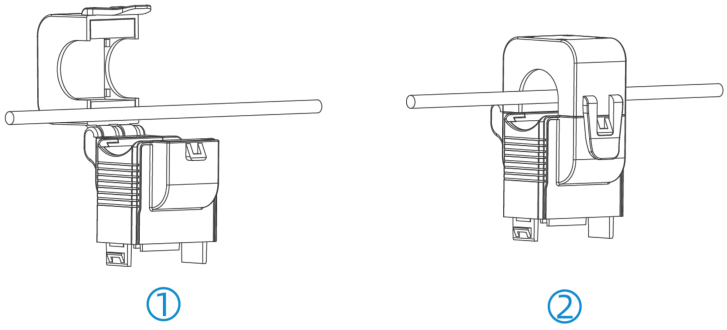
Note:

Keep the device away from metal objects, obstacles, or the environment surrounded by other electrical equipment that may cause interference. If necessary, please select a magnetic antenna.



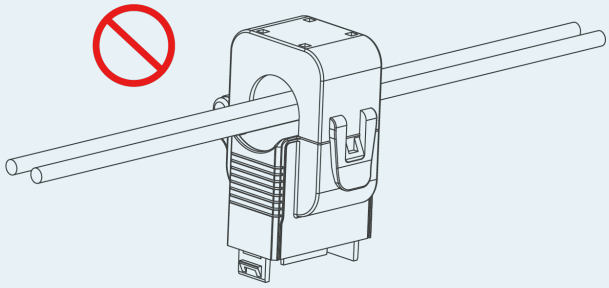
Transformer Installation

Open the current transformer to clip it around a single-phase wire. Then close the clip with a slight “click” sound to make sure the clip firmly grips the wire.



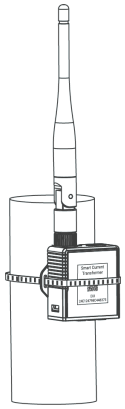
Note:

- Do not place Phase wire and Neutral wire within a single current transformer.



Transceiver Installation

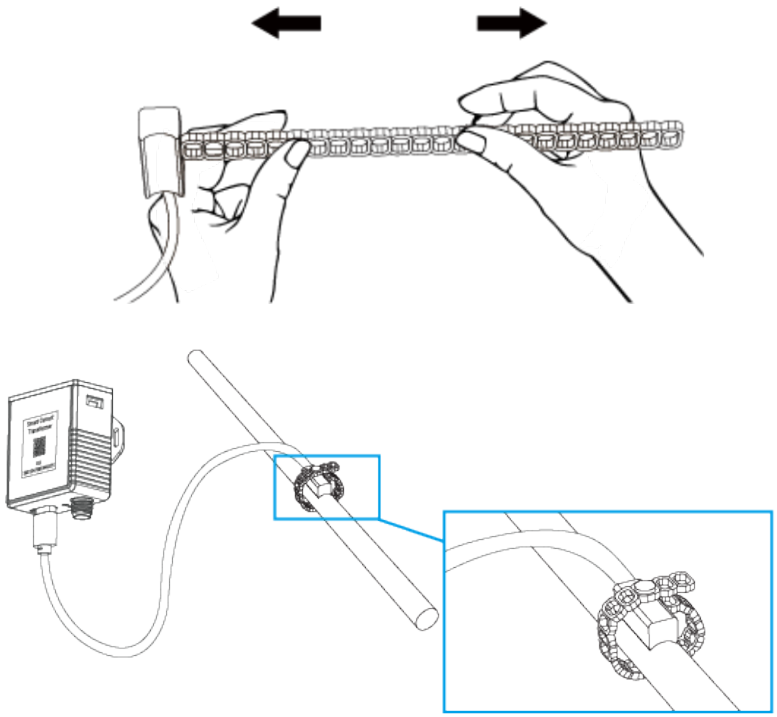
The transceiver can be put or hang in any suitable position or to be fixed via cable-ties.



USB-C NTC Sensor Installation (Alternative)

The device can monitor the temperature of the wire through the USB-C NTC Sensor, it will alarm when the temperature exceeds the threshold.

Pass the USB-C NTC Sensor around the tested wire, and then tighten the buckle. The other end is connected to the CT device via the USB Type-C.



Note:

Keep the USB-C NTC Sensor as close to the wire connector as possible to better detect the temperature.

Chapter 6. Uplink and Downlink

Overview

All messages are based on following format (HEX), the Data field should follow little-endian:

Channel1	Type1	Data1	Channel2	Type2	Data2	Channel3	...
1 Byte	1 Byte	N Bytes	1 Byte	1 Byte	N Bytes	1 Byte	...

For decoder examples please find files on https://github.com/Milesight-IoT/SensorDecoders.

Uplink Data

Basic Information

The device will report a basic information packet whenever joining the network.

Item	Channel	Type	Byte	Description
Power On	ff	0b	1	Device is on
Protocol Version	ff	01	1	Example: 01=V1
Serial Number	ff	16	8	16 digits
Hardware Version	ff	09	2	Example: 03 10 = V3.1
Software Version	ff	0a	2	Example: 03 01 = V3.1
TSL Version	ff	ff	2	Example: 01 00=>V1.0
Device Type	ff	0f	1	00: Class A, 01: Class B, 02: Class C, 03: Class C to B

Example:

ff0bff ff0101 ffff0101 ff166746d48016300014 ff090110 ff0a0101 ff0f00		
Channel	**Type**	**Value**
ff	0b	Power On: ff(Reserved)
ff	01	Protocol Version: 01(V1)

ff0bff ff0101 ffff0101 ff166746d48016300014 ff090110 ff0a0101 ff0f00		
Channel	**Type**	**Value**
ff	ff	TSL Version: 0101(V1.1)
ff	16	Serial Number: 6746d48016300014
ff	09	Hardware Version: 0100 (V1.0)
ff	0a	Software Version: 0101(V1.1)
ff	0f	Device Type: 00(Class A)

Periodic Report

The device supports to report below types of periodic report packets.

Item	Channel	Type	Byte	Description
Total Current	03	97	4	UINT32/100, Unit: Ah, Resolution: 0.01 Ah **Note:** when it reaches to max value FFFFFFFF (42949672.95), it will clear to 0 automatically.
Current	04	98	2	UINT16/100, Unit: A, Resolution: 0.01 A **Note:** FFFF means collection failure.
Temperature	09	67	2	INT16/10, Unit: °C **Note:** FFFD means overrange temperature; FFFF means collection failure.

Example:

Periodic packet: report as reporting interval (10 minutes by default).

039773020000 04980019 09673401		
Channel	**Type**	**Value**
03	97	Total Current: 73 02 00 00=>00 00 02 73=627/100=6.27 Ah
04	98	Current: 00 19=>19 00=6400/100=64A
09	67	Temperature: 34 01=>01 34=308/10=30.8°C

Alarm Report

The device supports to report below types of alarm report packets.

Item	Channel	Type	Byte	Description
Current Alarm	84	98	7	Byte 1-2: Max. Current Byte 3-4: Min. Current Byte 5-6: Latest Current Byte 7: Alarm Status, 01: Threshold alarm 02: Threshold alarm dismiss 04: Overrange alarm 08: Overrange alarm dismiss 05: Threshold alarm + Overrange alarm 0a: Threshold alarm dismiss + Over-range alarm dismiss **Note:** Max./Min. Current means the maximum or minimum value between last report and current report.
	89	67	3	Byte 1-2: Temperature, INT16/10, Unit: °C

Item	Channel	Type	Byte	Description
Temperature Alarm				Byte 3: 01-Threshold alarm; 00-Threshold alarm dismiss

Example:

Current alarm or alarm dismiss packet:

8498 b80b d007 c409 01		
Channel	**Type**	**Value**
84	98	Max. Current: b8 0b=>0b b8=3000/100=30A Min. Current: d0 07=>07 d0=2000/100=20A Latest Current: c4 09=>09 c4=2500/100=25A Alarm Status: 01=>Threshold alarm

Downlink Command

The device supports downlink commands to configure the device. Application port is 85 by default.

General Setting

Item	Channel	Type	Byte	Description
Reboot	ff	10	1	ff
Clear Accumulated Current	ff	27	1	01 **Note:** when it reaches to max value FFFFFFFF (42949672.95Ah), it will clear to 0 automatically.
Reporting Interval	ff	8e	3	Byte 1: 00 Byte 2-3: UINT16, Unit: minute

Example:

1. Reboot the device.

ff10ff

2. Set report interval as 20 minutes.

ff8e001400		
Channel	**Type**	**Value**
ff	8e	1400=>0014=20minutes

Alarm Setting

Item	Channel	Type	Byte	Description
Thresh-old Alarm	ff	06	9	Byte 1: **Bit0~Bit2:** 000-disable 001-below (minimum threshold) 010-over (maximum threshold) 011-within 100-below or over **Bit3~Bit5:** 001-Current 100-Temperature **Bit6~Bit7:** 00 Byte 2-3: Min. value, Unit: A or 0.1°C Byte 4-5: Max. value, Unit: A or 0.1°C Byte 6-7: Alarm Reporting Times, Range: 1~1000

Item	Channel	Type	Byte	Description
				Byte 8-9: Alarm Reporting Interval, Unit: min
Alarm Reporting Interval	ff	02	2	Unit: min, Range: 1~1440
Alarm Reporting Times	ff	f2	2	Range: 1~1000

Example:

Enable current threshold alarm and set maximum threshold as 60A, reporting time as 2 and reporting interval as 5 minutes.

ff 06 0a0000 3c00 02000500		
Channel	**Type**	**Value**
ff	06	0a=00001010=>over current maximum threshold Min. value: 00 00=0 Max. value: 3c 00=> 00 3c=60 A Alarm Reporting Times: 02 00=>00 02 =2 Alarm Reporting Interval: 05 00=>00 05=5 mins

Chapter 7. Services

Milesight provides customers with timely and comprehensive technical support services. End-users can contact your local dealer to obtain technical support. Distributors and resellers can contact directly with Milesight for technical support.

Technical Support Mailbox: iot.support@milesight.com

Online Support Portal: https://support.milesight-iot.com

Resource Download Center: https://www.milesight.com/iot/resources/download-center/

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